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DESCRIPTION OF A NEW BRASS RIVER GAGE AT RICHMOND, VA., AND ITS METHOD OF SUPPORT.

By O. D. LEISENRING, Observer, U. S. Weather Bureau.

During a severe flood in February, 1899, when heavy ice moved out of the James River with exceptional violence and

gorged in constricted parts of the channel, the wooden river gage of the Weather Bureau at Richmond, Va., was seriously damaged and in due time the erection of a brass gage to replace it was authorized. Some peculiar features attach to the exposure of this gage, and they rendered the manner of its erection a subject for serious consideration. A method was finally devised which, although somewhat novel, was approved by the Chief of the Weather Bureau, and the work has been performed in accordance with it. In the hope that some suggestion valuable to others may be derived from it, this brief description of the plan is prepared.

Many small rocky islets dot the falls of the James River at Richmond, and a larger island, with a soil formation superposed, closes the group and extends into the tidewater below. The Richmond and Danville Railroad Company owns the land abutting on the mainland bank of the east channel, and has protected it with a retaining wall of granite masonry about 27 feet high. The old gage, located as nearly as possible at the foot of the falls, was attached in a vertical position to the face of this wall by iron holdfasts. Since the batter of the wall is nearly 3 feet, it follows that the gage stood off from the wall that distance at its top and proportional distances all the way down to zero. This construction gave rise to the danger of drift and floating ice wedging between the wall and the gage and damaging or destroying the latter. The danger was augmented by the constriction of the channel at this point, and by the increased rapidity of flow in times of high water. It was therefore considered that in erecting a new gage of material practically imperishable care ought to be taken to protect it from the possibility of destruction by violence. Two methods of accomplishing this result were at first considered: one by cutting a flaring recess in the face of the wall, having at its back a plumb surface of sufficient width for attaching the gage; and the other by making a shallow channel down the face of the wall, deep enough only to develop a plane surface throughout and to afford protection to the brass scale. Both of these methods were objectionable. The former as to cost, uncertainty about the thickness of the wall near its base, and the probable deposits of sediment and debris in the lower part of the recess; the latter because the gage would thus have an inclination with the face of the wall, and its readings would require a correction to be applied whenever they exceeded 3 feet or thereabout. The suggestion to attach a buttress of cement concrete to the wall, and to mount the gage on its plumb face, was finally considered and adopted.

This buttress has the shape of an inverted wedge of trapezoidal cross section. The thin end is recessed in the wall and is of sufficient thickness to be stable, and to hold the expansion bolts for fastening the gage. Thence it rises with its plumb face of uniform width (about 24 inches) to the height required, its inclined face resting on the wall and widening as it rises, and its sides forming up in the flaring triangular figures thus developed. It thus presents, at any stage of water, either a surface flush with the wall, or a projecting configuration well adapted to deflect or to resist the impact of any floating body. Probably few floating objects, save pack ice, will ever touch it, owing to the deflection of the carrying current by dead water before reaching the buttress.

The method of construction was as follows: The surface of the wall to be covered by the buttress was cleaned and all loose mortar and spalls scraped from the joints of the masonry. Holes were drilled for a row of anchor bolts spaced two feet vertically, and located alternately on each side of the gage seat. These bolts are of $\frac{1}{2}$ inch iron, and extend to 6 inches from the plumb face. Some extra anchors were inserted in convenient open joints of the masonry, and all were set in neat Portland cement. A mould was erected consisting of two heavy planks placed vertically, and securely

stayed to form the front of the buttress. On the inner side of these planks was placed a template of the gage, having fixed in it wooden pegs of proper size, and so spaced as to form holes for the expansion nuts of the holding on bolts. The template itself moulded the recess for the brass scale. On the inner side of the heavy planks, and on the downstream side of the template, the right-hand side as one reads it, wood figures sawn from $\frac{1}{4}$ -inch stuff, were tacked to form indented figures in the concrete face opposite the foot marks. The space to be occupied by the buttress was then boxed in as the work of filling progressed, with short horizontal boards, extending from the edges of the vertical planks to the face of the wall and flaring with angles of 45° . Portland cement concrete of about the character used in the best cement walks and curbs, constituted the filling. Next to the wall the mix was of fine gravel, and strong mortar was freely used in flushing into the joints and interstices of the wall, and in forming the bond with its face. The work was carried up in comparatively thin sections to give opportunity for the setting of the cement, and two weeks were allowed for hardening after the completion of the filling, before the mould was removed. The brass scale was then bolted in, and the surfaces were smoothly troweled with neat cement.

The weight of this structure is about 22,000 pounds, and the holding surface, that is, the area of the bond between buttress and wall, approximately 16,000 square inches, so that even with indifferent construction the work would be reasonably secure. With good construction and the addition of anchor bolts, its permanence can not be doubted, and may be held to depend only upon the stability of the supporting wall.

THE CLIMATE OF ST. LAWRENCE ISLAND.

By Mr. A. J. HENRY, Chief of Division.

St. Lawrence, the largest island in Bering Sea, is situated in latitude 64° N., longitude 170° W. It is about 400 miles north of the well-known Pribilof group and about 200 miles south of the Arctic Circle. The nearest land, the Siberian coast, is a little less than 100 miles distant.

The Presbyterian Board of Home Missions built a schoolhouse in the Eskimo village of Chib-u-Chak (Gambell) on the extreme northwest corner of the island in 1891, but it was impossible to secure a teacher until some years later. The first teacher secured by the board, Mr. V. C. Gambell, kindly consented to make meteorological observations while on the island. He began observing in October, 1894, and continued until September, 1897. Mr. W. F. Doty succeeded him as observer in November, 1898, observing regularly until he left the island in June, 1899.

Mr. Gambell was supplied by the Weather Bureau with standard self-registering thermometers and a rain gage. He did not succeed in measuring the precipitation, but we are indebted to him for a valuable series of temperature observations, which we have summarized in the accompanying tables. Mr. Gambell's record has been supplemented by the observations made for eight months by Mr. Doty. The latter did not have self-registering maximum and minimum thermometers, but it is evident from the observed extremes he has furnished that he kept close watch on the thermometer. In transmitting his observations to the Central Office, Mr. Doty writes as follows:

I have the honor to transmit herewith some meteorological observations made by me at Gambell, St. Lawrence Island, extending from November 1, 1898, through to July 11, 1899. The thermometer used was a Fahrenheit, and I fancy was quite accurate. It was not provided with an automatic register. Observations were made three times a day. I did not have a barometer, a rain or snow gage, or any instrument to gage the velocity of the wind. I guessed at the force of the wind and found that one of the whaling captains confirmed my esti-

mate of the strength of a gale in the late spring, and believe that, as a rule, I did not overestimate. The maximum and minimum thermometers were out of order and so could not be used. It was quite impossible to estimate the depth of snowfall, as the wind blows the snow into the air from the ground, while it is snowing and the snow is piled into great drifts in places and carried off elsewhere. A question mark has been placed in the column for the record of snowfall to designate that snow fell on that day.

Before taking observations daily I observed the thermometer from time to time during October and noticed a very gradual lowering of the temperature during the month. I fancy that this steadiness during the latter part of September and October was remarkable in contrast with the change from day to day in the winter. The spring greatly resembled the fall in this respect, save that of course the temperature rose.

Temperatures observed at Gambell, St. Lawrence Island, Alaska (latitude, $63^\circ 34' N.$; longitude, $171^\circ 45' W.$)

MONTHLY MEAN TEMPERATURES (Max. + Min.) $\div 2$.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1894.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	27.5	19.3	5.9
1895.....	4.2	-8.0	0.6	14.8	28.8	37.6	43.6	42.8	38.3	27.3	21.9	1.3
1896.....	2.8	-12.8	1.4	16.4	28.4	34.7	42.7	41.7	36.4	30.0	23.5	6.5
1897.....	5.0	3.4	-3.4	12.5	29.4	37.9	45.5	46.8	38.6	.....	.....	.....
1898.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23.8	7.3
1899.....	6.8	6.8	14.5	14.9	31.5	36.5	.....	.....	.....	.....	.....	.....
Means....	4.6	-2.6	3.3	14.6	28.0	36.7	43.9	43.6	37.8	28.3	23.4	5.2

MAXIMUM TEMPERATURES.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1894.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	42	34	33
1895.....	28	14	32	37	45	48	59	59	50	42	36	30
1896.....	29	25	35	38	35	45	54	51	48	39	35	30
1897.....	31	33	33	34	44	62	56	57	50	.....	.....	.....
1898.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	34*	31
1899.....	30	35	35	42	38	46	.....	.....	.....	.....	.....	.....
Extremes..	31	35	35	42	45	62	59	59	50	42	36	33

MINIMUM TEMPERATURES.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1894.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	5	-18
1895.....	-21	-31	-23	-18	12	27	34	34	23	18	0	-25
1896.....	-18	-25	-29	-6	8	26	30	32	31	16	16	-17
1897.....	-15	-22	-31	-9	17	26	33	36	29	.....	.....	.....
1898.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8*	-19
1899.....	-20	-10	-16	0	18	30	.....	.....	.....	.....	.....	.....
Extremes..	-21	-31	-31	-18	8	26	30	32	21	15	0	-25

* Observed readings November, 1898, to June, 1899.

Miscellaneous data for Gambell, St. Lawrence Island, Alaska.

Weather and wind.	1898.		1899.						
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
Clear days.....	1	8	11	12	8	4	3	0	1
Partly cloudy days.....	4	6	11	8	3	5	7	4	4
Cloudy and foggy days.....	25	17	9	8	20	21	21	26	6
Prevailing winds.....	ne.	ne.	ne.	e.	ne.	ne.	e.	sw.	sw.
Number of times observed from—									
North.....	2	10	17	8	3	6	11	2	.....
North-northeast.....	4	.....	.....	.....	.....	.....	.....	.....	.....
Northeast.....	34	34	39	15	29	47	21	3	5
East-northeast.....	4	.....	.....	1	1	1	.....	.....	.....
East.....	23	22	1	29	2	9	20	3	1
East-southeast.....	1	.....	.....	.....	.....	.....	.....	.....	.....
Southeast.....	2	10	4	7	17	7	4	.....	1
South-southeast.....	.....	.....	.....	.....	8	1	1	.....	.....
South.....	4	2	21	5	8	5	8	3	6
South-southwest.....	.....	.....	.....	.....	.....	6	2	1	.....
Southwest.....	5	2	.....	.....	16	2	3	39	11
West-southwest.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
West.....	.....	.....	.....	2	1	5	.....	27	4
West-northwest.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Northwest.....	7	.....	3	.....	1	.....	3	1	.....
North-northwest.....	1	.....	.....	.....	.....	.....	.....	.....	.....

NOTE.—Out of a possible 664 observations the wind was observed to be northeast 227 times, giving an approximate percentage of 34; east wind, 119 times, approximate per cent, 18; this leaves 308 possibilities for all the other 14 directions, or 48 per cent. In the table the data for